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COMMAND AND CONTROL IN JOINT VISION 2010: FLEXIBLE, ADAPTIVE,
AND NETWORKED

By

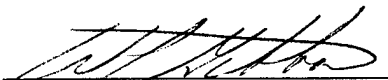
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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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One of the most daunting tasks the U.S. military will face in the 21st century is the issue of implementing effective command and control (C2) of joint and coalition military operations. As new technologies are implemented to support Joint Vision 2010 (JV 2010), successful C2 must give the commander the flexibility to use faster and more accurate information technologies in order to increase battlespace knowledge and situational awareness.

The dynamics of new technologies is linked to the Information Age and is commonly referred to as a Revolution in Military Affairs (RMA), which is leveraged through the enabling concepts of "Information Superiority" and "Network-Centric Warfare." The challenge for the future commander is to exploit the RMA by applying a flexible C2 process to control the battlespace. Thus, as networked forces bring faster and more accurate information across all levels of war, the operational commander will exert his influence by maintaining a flexible networked architecture through a continuum based on his intent and the tempo of operations.

A more focused understanding of networked C2 is the key to the evolution of new and existing joint architectures in order to keep pace with information technologies. The military must embrace an aggressive transition to a more flexible organization that is linked to a networked hierarchy to meet the challenges of the 21st Century.

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INTRODUCTION

One of the most daunting tasks the United States military will face in the 21st century is the issue of achieving effective command and control (C2) of joint operations as new technologies are implemented to support Joint Vision 2010 (JV 2010). The overall effect of JV 2010 concepts is to give the commander "Information Superiority" to increase his battlespace knowledge and situational awareness--information enhances knowledge, knowledge enhances the power to fight and win. Subsequently, effective C2 must give the commander the flexibility to use the power of shared awareness made available through information technologies. Thus, as networked forces bring faster and more accurate information across all levels of war, the operational commander will exert his influence by maintaining a flexible networked architecture through a continuum based on his intent and the tempo of operations.

Accordingly, the military will require a transition from a C2 architecture that is based on a Cold War organization, to a networked architecture and process that leverages off the power of "Network-Centric Warfare," and the enabling concepts of "Speed of Command" and "Self-synchronization."¹ The capacity to function successfully in a complex and networked environment is linked to the Information Age and is referred to as the Revolution in Military Affairs (RMA). The challenge for the commander is to exploit the RMA by applying a flexible C2 process and architecture to effectively control the battlespace.

Ultimately, the speed of command must be synchronized through strict information management, which will result in the tendency to centralize C2 as the higher echelon commanders receive real-time situational awareness through a networked Common Operational Picture (COP). JV 2010 clearly states that, "commanders at higher echelons will

use these technologies to reduce the friction of war and to apply precise centralized control when and where appropriate.”² Thus, in order to keep pace with information technologies, a more focused understanding of networked effects on C2 is the key to the evolution of new and existing joint architectures.

This paper will examine the impact that the RMA and “Information Superiority” will have on the C2 function in future warfare as envisioned in JV 2010. It will evaluate the challenges in C2 as the armed forces leverage new technologies to achieve Information Superiority through network-centric operations. Information Superiority will provide the Commander-in-Chief (CINC), and Joint Force Commander (JFC) with a high level of battlespace awareness and the ability to monitor and directly control tactical actions. This leads to a discussion of the current trend towards centralization of C2. This paper also examines how the advances in information technology will ultimately require a transition to a flexible and adaptive C2 process and architecture, which requires an understanding of networked effects on an organization. From this examination, it will become clear that a flexible C2 process, as opposed to a more restrictive “centralized” process, must be linked to a networked hierarchy, requiring a more aggressive approach to meet the challenges in the 21st century.

IMPACT OF TECHNOLOGY IN JV 2010 ENVIRONMENT

The Information Age will have a profound impact on all aspects of the armed forces. Technological advances in near-real-time processing of information will provide commanders with a common picture of the battlespace in an attempt to mitigate “the fog of war.” This acceleration of technology in information processing will force fundamental changes in future military operations. The change that must occur is captured in JV 2010, which provides an

operational concept of joint warfighting through enhanced battlespace awareness in a full spectrum of conflicts. The four pillars of JV 2010 are Dominant Maneuver, Precision Engagement, Focused Logistics, and Full Dimensional Protection. These four concepts combined will allow the 2010 JFC to achieve "Full Spectrum Dominance" across the range of military operations.³ The central precept for JV 2010 concepts is "Information Superiority"--the ability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same.⁴ Overall, Information Superiority will have the biggest impact on the most important function in military operations--C2. As the information-based RMA unfolds, it is imperative that adaptation of effective C2 keep pace with the military's quest to reduce the fog of war. However, adaptation of effective C2 will not follow automatically as the availability of information technology increases. Tomorrow's commanders must develop the capacity to use change and experimentation as necessary to keep pace and evolve with the technology.

NETWORK-CENTRIC WARFARE

The key to achieving JV 2010's goal of "Full Spectrum Dominance" is the Navy's description of the future environment called "network-centric warfare." The aim of network-centric warfare is to use advanced technologies to establish a real-time information network, which enhances a higher level of awareness through concepts such as "Speed of Command" and "Self-synchronization."⁵ Information Superiority achieved through network-centric operations will fundamentally change the nature of war, which will force a change in the C2 processes and architectures. As the military develops speed of command through network-centric operations, all levels of warfare will require an architecture that is supported by "value-adding C2 processes, many of which must be automated to get required speed."⁶

Thus, integrated sensors on an information network during high tempo operations will result in faster decision-making through geographically dispersed forces.⁷ The dynamics of networking will have a deep impact on C2 processes and organizations as commander's coordinate and link information from the sensors to the shooters.

PROSPECTS AND CHALLENGES IN JV 2010 C2

The impact of network-centric warfare will affect all levels of war, from the National Command Authorities (NCA) down to the tactical level. As stated by Vice Admiral Cebrowski, "We are in the midst of a Revolution in Military Affairs unlike any seen since the Napoleonic Age."⁸ It is through the information-based RMA that network-centric operations realize the full potential of increased situational awareness. As the military achieves Information Superiority, an accurate and relevant picture of the battlespace will require a new understanding of shared awareness for all joint and coalition forces. The centralizing element in maintaining a coherent C2 in a network-centric force is the COP, or shared awareness, that combines commander's intentions, present conditions, planning for future operations, and optional courses of action.⁹ The COP will have major impact on operational art and will ultimately close the information gap between CINC/JFC and tactical commanders. Overall, the COP will allow the JFC to synchronize his battlespace by exercising an increased span of control, and will require a flexible C2 architecture to enhance the combat potential of networked operations. The challenge will be to structure the appropriate C2 architecture, through a coherent COP, to achieve organizational effectiveness utilizing JV 2010 concepts.

Another outgrowth of information technologies is that self-synchronization, through organization and synchronization of warfare activities from the bottom up, blurs the levels of war and impacts the top-down hierarchy.¹⁰ The challenge will be to apply the appropriate

control to leverage network-centric warfare and enhance command decisions at all levels of war. Regardless, the implementation of hierarchical changes must ensure commanders maintain flexibility in the decision-making process. Moreover, the 2010 operational commander will lean towards a more flexible C2 to handle all facets of command including coordination, integration or control of Non-Governmental Organizations, Private Volunteer Organizations, and International Organizations. A further challenge is responding with a C2 structure that can adapt to a full spectrum of conflict, such as peace operations, while maintaining the combat effectiveness of the warfighter.

Increasingly, a potential consequence of new technology is the prospect of overwhelming the commander as networked information flow allows all echelons to share and monitor the COP and "commander's intent." As an example, Information Superiority and speed of command will allow the JFC to conduct continuous operations instead of distinct decision cycles.¹¹ Accordingly, the challenge will be to reduce the risk of overwhelming the commander and providing too much information, thereby exceeding his "span of control."¹² Thus, a commander's span of control will widen as technology increases real-time data flow to all levels of command, thereby, eliminating levels of control and reducing the number of command echelons. This becomes a critical issue as the CINC transitions from peacetime operations to combat operations. Additionally, a CINC or JFC must consider the implication of integrating a coalition of multi-national forces into the COP, where complex C2 arrangements will ultimately lead to an increase in the commander's span of control.

KNOWLEDGE IS POWER / THE HUMAN ELEMENT

As defined in Joint Publication 1-02, command and control is "the exercise of authority and direction by a properly designated commander over assigned and attached

forces in the accomplishment of the mission.”¹³ As the armed forces enter the 21st century, Information Superiority will provide the CINC or JFC with a high level of battlespace awareness and the ability to monitor and directly control tactical actions. An argument can be made that the proliferation of information technologies will continue to increase the span of control for the designated commander. For example, Information Superiority will enhance the horizontal effects of networking as the self-synchronizing of forces provides a means for increased situational awareness and span of control throughout the hierarchy. Therefore, in an era of real-time battlespace knowledge, one must consider the influence of human behavior on the network during combat operations.¹⁴

Despite the tremendous increases in technology that will be applied to the C2 function, the commander will always need to keep a “man in the loop” to effectively maintain his increased span of control in a networked hierarchy. As the operational commander struggles with the effects of speed of command and self-synchronization, the “man in the loop” will become a critical factor in a networked environment. In a larger context, it is this human presence in a networked environment that will require a flexible command structure to ensure that the decision-making process does not circumvent the responsible authority. Even as network-centric warfare enhances situational awareness, a “man in the loop” will be required to maintain effective C2 as technology improves the flow of real-time battlefield information both inside and outside of the command hierarchy. In the end, JV 2010 C2 will still require human actions to make final “sanity checks” on networked and automated decision aids.

TRENDS AND EXAMPLES OF CENTRALIZATION

As stated in Joint Pub 3-0, the CINC may exercise Combatant Command (COCOM) “directly over specific operational forces that, because of the mission assigned and the

urgency of the situation, must remain immediately responsive to the CINC.”¹⁵ Political sensitivities may require the involvement of the NCA, CINC or JFC to apply direct control of forces to cope with the dynamics of future warfare. One example of a CINC’s direct control of military operations was General Schwarzkopf as Commander-in-Chief, Central Command (CINCCENT) during the 1990-91 Persian Gulf War. CINCCENT was not only the JFC; he was also the Joint Force Land Component Commander.¹⁶

Conversely, while maintaining centralized C2, it is the concept of decentralized execution that creates confusion at all levels. Centralized C2 does not necessarily mean centralized execution. Tight control of operations may still require decentralized execution down to the lowest tactical level. One example is the recent use of cruise missiles against terrorist camps and biological warfare targets in Afghanistan and Sudan. This operation required tight control at the strategic level, while execution remained at the tactical level. Nevertheless, Concepts for Future Joint Operations (CFJO) recognized the potential impact of technology in future operations by stating, “... information systems could provide such a level of battlespace awareness that senior commanders could have the ability to monitor and directly control the actions of junior leaders and the trend could be reversed to a more centralized execution.”¹⁷ Regardless of what level of centralization is applied by the commander, the underlying concepts of C2 and execution must be clearly defined before deciding on the architecture.

In some instances, the CINC or JFC may require an organizational option that allows for highly centralized control to achieve an operational effect. One example is the use of Precision Guided Munitions (PGM) as a way to generate the desired effect of “Precision Engagement.” As one of the four pillars of JV 2010, the concept of Precision Engagement

will “consist of a system of systems” and will “provide responsive command and control.”¹⁸ Increasingly, it is the lethality and accuracy of PGM’s that has made their use more attractive during contingency operations since the end of the Persian Gulf War. Based on advances in technology, political sensitivities, and the NCA’s insistence to minimize collateral damage and the loss of lives, the trend will continue towards centralized C2. Furthermore, the overall effect of Precision Engagement will require a flexible and centralized control mechanism to ensure strict compliance with the CINC’s time constraints, target selection, and the inherent nature of political sensitivities.

In contrast, the arguments presented for centralizing C2 at the operational level could also be applied to any other level of command. If the same technology is available to all levels of command, why choose one level for centralization over another? Why place limits on our capabilities and options? Additionally, information technology may cause a commander to centralize all decisions, which could have a negative effect on the operating tempo (OPTEMPO). One can argue that controlling information and decision-making at a higher level defeats the concept of network-centric operations, and the ability to enhance speed of command and self-synchronization. Whichever form the C2 process takes in the future, commanders must recognize the current trend toward centralization as the military takes advantage of information technologies.

BATTLE EXPERIMENTS

In order to fully exploit the current RMA, the Navy and Marine Corps has initiated a series of warfighting experiments to explore emerging technologies during exercises in accordance with JV 2010 concepts. The Navy’s Fleet Battle Experiment Alfa (FBE-A) and Marine Corps Hunter Warrior (HW) experiment demonstrated a shared COP that allowed a

JFC and a Marine Air-Ground Task Force (MAGTF) to command at the operational level.

These experiments also evaluated the Naval Surface Fire Support concept called the "Ring of Fire," which is the capability of quickly answering calls for fire on a single network.¹⁹

Throughout FBE-A/HW, observers recognized the problem of airspace deconfliction that was associated with "Ring of Fire" as follows: "... because of the extended range of future munitions, airspace deconfliction will be an extremely complex challenge in the future. Even in a relatively small scale joint operation, the lowest level at which deconfliction may be accomplished will be at the joint force component level or the joint force level."²⁰ These experiments revealed some difficulties in decentralizing C2 when applying networked combat in high-tech warfare. Direct connectivity between senior headquarters and warfighters with high-tech weapons "makes the traditional pyramid-shaped command hierarchy flat by discarding the intervening echelons that traditionally passed and filtered information between those that command and those who execute."²¹ In summary, the FBE-A/HW experiments show how an extremely flat organization between the JFC, MAGTF, and troops in the field equated to extreme centralization of the C2 process and architecture.²² The end result was a flattened and fully netted C2 organization that increased the JFC and MAGTF span of control, which ultimately led to a faster decision-making process through speed of command.

Fleet Battle Experiment Bravo (FBE-B) again studied the "Ring of Fire" concept and the employment of Global Positioning System Guided Munitions (GGMs) which enabled the JTF staff to both plan and execute fires in the Joint Operations Area. Although this is another example of a C2 concept that is extremely centralized, the successful innovation of C2 structures through warfare experimentation must continue to address the multidimensional requirements of precision engagement. Most would agree that precision standoff weapons in

future wars and contingencies will have a profound impact on all aspects of the operational function of C2. Subsequently, a technology-based force will require a flexible and responsive C2 process and architecture to remain effective on the 21st century battlefield.

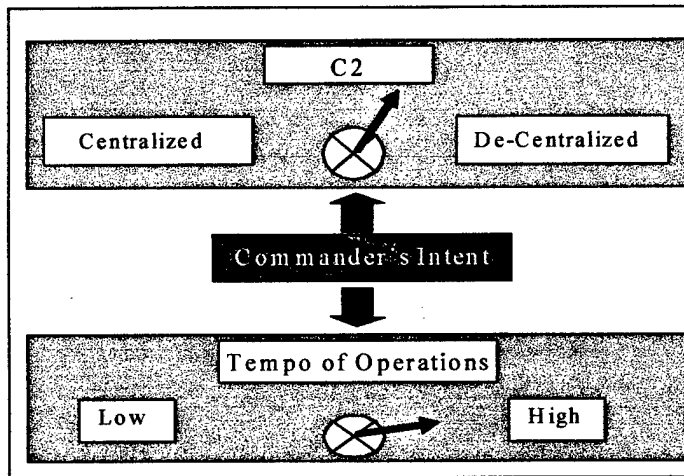
FLEXIBILITY FOR THE COMMANDER

As demonstrated above, the cumulative effects of Information Superiority will lead to a movement towards a more centralized C2 as networked forces bring faster and more accurate information from the lower echelons directly to the operational commander. As stated in CFJO, "Clearly the intent of JV 2010 is to use information technologies to decentralize the execution of operations while allowing for appropriate involvement of the higher-level commander."²³ The overall goal of the combatant commander is to reduce the fog of war, and apply precise centralized C2 when and where appropriate, to maintain decentralized execution and command by negation.²⁴ However, it is important to remember that speed of command and self-synchronization will have a centralizing effect on operations as the commander struggles to integrate sensors on an information network during high tempo operations. Thus, the theater or operational commander will be required to adapt his span of control of the battlespace and the information network to meet all assigned missions. This will be accomplished by maintaining a flexible C2 process and applying centralized C2 when needed or directed from higher authority.

Yet, another way to consider centralization or decentralization of C2 is through a continuum.²⁵ As different operations fall on the continuum, factors such as commander's intent and speed of command act as a barometer to assist the commander in deciding how to control the OPTEMPO (see Figure 1).²⁶ As the OPTEMPO increases, C2 adapts to a flexible process and begins to decentralize; thereby decreasing the commanders span of control by

delegation of authority to another echelon. Conversely, as the OPTEMPO decreases, the centralization of C2 and the span of control increase. Furthermore, a commander will have the flexibility to set the OPTEMPO and exert his influence based upon the amount of control that is required to execute his intent.

Figure 1. Command and the Tempo of Operations²⁷



In order to capitalize on network-centricity, flexibility must be maintained to provide a means to ensure the appropriate level of centralization or decentralization is applied to the mission. For example, a low tempo cruise missile strike requires centralization, whereas soldiers fighting in a high tempo “forced entry” operation or in urban warfare would require decentralization.

AFFECTS OF C2 ON DECISION-MAKING

Whether centralized or decentralized, network-centric operations will involve dynamic decision-making as forces integrate knowledge throughout all the levels of war.

Real-time information will require real-time decision-making if it is to contribute in a positive fashion. In contrast, there is no guarantee that the commander will actually decide faster simply because he has much more and better information. A poorly trained commander and

his staff could misuse networked information and thereby, be unable to refine the decision-making process through the COP. Thus, he is unable to tailor real-time information to his specific needs and objectives. This could result in extreme centralization of C2 and an increase in span of control, which could hinder the decision-making process. Overall, the operational commander must understand the networked effects of his forces in his battlespace and ensure access is available to provide the commander's intent, direction and rules of engagement on a real-time basis.

C2 ARCHITECTURE

Whether the C2 process is centralized or decentralized, the commander will require an understanding of networked effects on future C2 architectures. Regardless of the impact of the RMA, some type of hierarchical organization is needed to support the decision-making process.²⁸ For example, decisions that risk human life, cause structural damage, and have political implications must require some form of a hierarchy for accountability purposes in future JTF's.²⁹ It is important to remember that command includes "the authority and responsibility for effectively using available resources to accomplish assigned missions."³⁰ More importantly, command includes accountability for decisions in the organization--advanced technology does not alleviate accountability and responsibility. Overall, the effect of networked operations will cause the CINC or JFC to impose hierarchical restraints to ensure accountability is maintained in a networked organization.

There are many organizational and cultural barriers that will be affected in a networked environment. In terms of connectivity, it is possible that complex operations of the future may require a flattened hierarchy in order to respond to short-fused contingencies. In this way, a flattened hierarchical organization that eliminates layers of command between the

commander and operational forces will enhance the decision-making process.³¹ The removal of layers will require realignment of organizational functions "either up to the commander's staff, down to the units or by reaching back to supporting organizations or experts."³² One concept that will require extensive analysis is the possibility of restructuring the regional combatant commands. In particular, consolidating the service component headquarters into the combatant command staffs. The current RMA, in addition to increased theater-level requirements, requires a reexamination of large service-component headquarters subordinate to the combatant commands.³³ The argument is that advances in information technology will require a flat and adaptive staff organization or flattened hierarchy with fewer layers between the CINC and the lowest tactical level. For example, Fleet Battle Experiment Delta (FBE-D) revealed that network-centric Theater Ballistic Missile Defense (TBMD) and Counter Special Operations Forces (CSOF) require a flexible architecture to leverage off increased battlespace awareness. Thus, FEB-D featured much shorter and direct connectivity between senior headquarters and the executors. The end result was that theater-level changes are required to increase organizational effectiveness to realize the full power of network-centric warfare and the COP.³⁴

While some proponents believe that the flattening needs to start at the top, others advocate that changes to C2 organizations must start at the operational or JTF level. Another organizational issue that has been studied is the development of a standing Joint Task Force (JTF) headquarters in each of the regional CINCs. The concept of a standing JTF headquarters is to provide the CINC with the capability of responding to a contingency or operation with a highly trained joint staff. One way to accomplish this is by having a standing JTF headquarters as a subset of the regional combatant commands, with the JFC

derived from the CINC's staff. The idea is that the JTFs "should be formed around the current headquarters of operational level units, such as V Corps in Europe or Seventh Fleet in the Pacific."³⁵ The value of this organization is unity of command through a fully integrated staff, which will allow a seamless transition from a peacetime environment into hostilities.

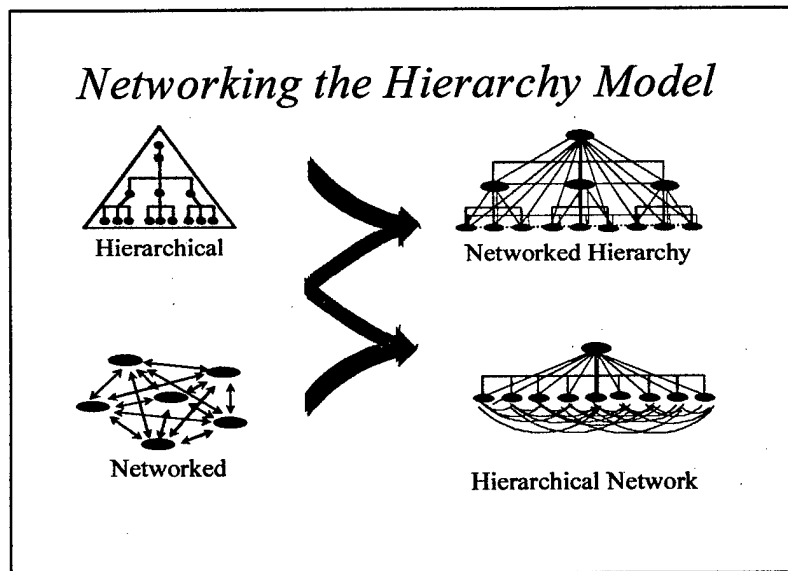
As established above, the elimination of command layers and the establishment of standing JTF headquarters are examples of ideas being discussed to address the question of C2 in future environments. Are reduced layers of command and fixed JTF headquarters the correct approach? One might argue that crises in multiple locations throughout the theater would require the establishment of several ad hoc JTF's, or the expertise of a service component commander, to delegate the CINC's authority and narrow his span of control. For example, smaller contingencies or operations such as Non-combatant Evacuation Operations may only require the leadership of a component commander or a task force commander, versus having a fixed organization respond to every crisis. Furthermore, future contingencies and operations may not give the standing JTF's the luxury of being brought into the planning cycle in the early stages of an extremely time-critical or politically sensitive mission. Without question, a "one size fits all" organizational approach cannot meet all the CINC's requirements across the spectrum of military operations.³⁶

NETWORKED HIERARCHY

The divergent perspectives concerning the future command structure point out the difficulties in designing a hierarchy that can meet the C2 challenges of advanced technologies. The organizational changes that must be addressed should concentrate on providing the commander the flexibility to leverage off information superiority and respond to a campaign or major operation with a hierarchy that is appropriate to the mission. What is

required is a closer look at how the military approaches the establishment of hierarchies. Traditionally, the C2 orientation is discussed in two-dimensional terms--hierarchy is either tall or flat. A useful way to conceive of a future networked environment is to think in three-dimensional terms, such as a netted galaxy, as illustrated in Figure 2.

Figure 2. Networking the Hierarchy³⁷



This hierarchical concept has many advantages over the historical two-dimensional model. Foremost, the hierarchy facilitates the flow of networked information both vertically and horizontally to facilitate the COP and the commander's intent. Secondly, this hierarchy provides flexibility to adapt the C2 process to an architecture that enhances a smooth transition from peacetime to war. Lastly, this concept will allow the commander to leverage network-centricity to enhance command decisions at all levels of war. For example, a "Hierarchical Network" (Figure 2) could be used to facilitate a C2 process to effectively execute a contingency that employs only PGMs. Whereas the "Networked Hierarchy" (Figure 2) would be used in a campaign or major operation to provide the commander organizational redundancy and the flexibility to adjust his span of control using adaptive C2

processes. An understanding of the network effects on the hierarchy will enable the commander to use speed and the mix of vertical and horizontal flow of information as a weapon.³⁸ Furthermore, this does not require the immediate creation of new organizations. What is needed is joint experimentation and adjustment of existing organizations to assist in comprehending the effects of networking.

To meet the challenges of a network-centric environment, the discussion and experimentation of future C2 process and structures should key in on the concept of providing depth versus flattening of the hierarchy. As the armed services strive to achieve their visions, such as the Army's *Force XXI* and the Navy's *Forward...From the Sea*, it will be critical for the services to coordinate an aggressive approach to C2 experimentation. This is necessary in order to understand the implications of emerging technologies and to ensure the C2 process remains flexible in a networked environment. Therefore, the goal is to integrate a three-dimensional networked hierarchy into existing organizations to assess the implications of near-real time battlespace knowledge, thus, providing a flexible and seamless C2 process for both joint and coalition forces.

While there is no question that the military must retain some form of a hierarchy, C2 architectures must evolve to account for the networked effects of Information Superiority. This will require immediate and bold experimentation now before information technologies completely overwhelm current C2 structures. An adaptive architecture must be maintained to ensure a flexible C2 process retains redundancy and accounts for increased span of control. Accordingly, the military must begin the cultural changes required to transform C2 hierarchies into relevant organizations to meet JV 2010's goal of "Full Spectrum Dominance."

CONCLUSION

As the military implements the concepts of JV 2010, it will take strategic thinking and vision to take advantage of the RMA and force a cultural change in the C2 function to meet the challenges of the 21st century. Our leaders need to embrace the change in information technologies and consider the impact that the COP and information superiority will have on future joint and coalition operations. As stated in CFJO "these revolutionary and previously unachievable capabilities are forcing us away from traditional notions about command, organizational design, and perhaps even the conduct of operations."³⁹ Thus, aggressive joint experimentation and adaptation of new and existing C2 organizations should begin now to keep pace with information technologies.

Through innovative thinking and experimentation, military leaders need to accept the concept of flexible and adaptive C2 to meet the full spectrum of conflicts and missions. As the trend will be to centralize operations, future commanders must become proactive to meet the post Cold War realities and consider centralization or decentralization of C2 through a continuum. Additionally, the political and military realities of the future, such as minimizing the loss of American lives, will force extensive changes to C2 architectures as the military transitions to a smaller and more lethal force.

A more focused understanding of the networked hierarchy is the key to the exploration of new C2 architectures in order to maintain organizational effectiveness across all levels of war. The military must adjust to and embrace the transition to a networked hierarchy. Finally, it is imperative that the military answers the question stated in CFJO, "Will Information Superiority fundamentally alter the nature of joint command and control (C2)?" The answer is yes--C2 must evolve into a more flexible and adaptive process and architecture.

Notes

¹ "Network-Centric Warfare" derives its power from the strong networking of a well-informed but geographically dispersed force. "Speed of Command" is defined as the process by which a superior information position is turned into a competitive advantage. "Self-Synchronization" is the ability of a well-informed force to organize and synchronize complex warfare activities from the bottom up. Author K. Cebrowski, and John J. Garstka, "Network-Centric Warfare-Its Origin and Future," U.S. Naval Institute Proceedings, January 1998, 35.

² Joint Chiefs of Staff, Joint Vision 2010. (Washington, D.C.:1996), 15.

³ "Full Spectrum Dominance" is defined as the capability to dominate any adversary and control any situation in any operation. Joint Warfighting Center, Concepts for Future Joint Operations (Fort Monroe, VA:May, 1997), 2.

⁴ Ibid., 35.

⁵ Cebrowski and Garstka, 32.

⁶ Ibid., 32.

⁷ Ibid., 35.

⁸ Ibid., 29.

⁹ Naval War College, Report on Global 98 – Network-Centric Warfare (Newport, R.I.: July, 1998).

¹⁰ Cebrowski and Garstka, 35.

¹¹ Joint Warfighting Center, Concepts for Future Joint Operations, 3.

¹² Navy Department, Strategic Concepts Workshop IX, Network-centric Command and Control Concepts for the 21st Century Navy, Naval War College, November 1998, 1.

¹³ Joint Chiefs of Staff. Department of Defense Dictionary of Military and Associated Terms. (Joint Pub 1-02) (Washington, D.C.:March 23, 1994), 85.

¹⁴ Naval War College, Report on Global 98 – Network-Centric Warfare (Newport, R.I.: July, 1998).

¹⁵ Joint Chiefs of Staff. Doctrine for Joint Operations (Joint Pub 3-0) (Washington, D.C.:February 7, 1996), II-7.

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